

CLAIMS

1. Apparatus for compensating image signals produced by
5 a CCD imager for smears, the CCD imager including a
multiplication register for multiplying charge produced by
the CCD imager, the apparatus comprising:
an image data analyser for detecting the boundaries
of a smear; and
10 an image data replacer for replacing data between the
boundaries of a detected smear with alternative image
data, wherein the image data analyser is arranged to
detect the boundaries of horizontal smears produced by
incomplete charge transfer in the multiplication register.
15
2. Apparatus according to claim 1, wherein the image
data analyser comprises means for detecting the boundaries
of a smear by detecting rates of change in the image data
greater than a predefined limit
20
3. Apparatus according to claim 1 or 2, wherein the
alternative image data is derived from image pixels
neighbouring the detected smear.
- 25 4. Apparatus according to claim 1 or 2, wherein the
alternative image data is derived by interpolation of
image data.
5. Apparatus according to claim 2, 3, or 4, wherein the
30 image data analyser analyses the image line by line to
detect intensity gradients greater than the predefined
limit.
6. Apparatus according to any preceding claim, wherein
35 the image data analyser comprises a kernel for analysing a
portion of the image data at a time.

7. Apparatus according to claim 6, wherein the kernel has a sliding window to define the portion of the image being analysed by the kernel and moveable across the image to analyse the complete image.

5

8. Apparatus according to any preceding claim, comprising a temporal integrator for integrating at least two images acquired by the CCD imager prior to boundary detection by the image data analyser.

10

9. Apparatus according to any preceding claim, comprising a coordinate extractor for extracting the coordinates of the smear boundaries and providing the extracted coordinates to the image data replacer.

15

10. Apparatus according to any preceding claim, wherein the image data analyser detects the boundaries of vertical smears produced on transfer of image data from pixels of the CCD imager.

20

11. Apparatus according to any preceding claim, wherein the CCD imager comprises an image area having a plurality of rows of pixels for accumulating charge during an image acquisition period, each row corresponding to a line of the image, an output register for receiving accumulated charge row by row during a transfer mode to produce line signals, and at least one row of pixels masked from incident radiation arranged on the side of the image area opposite the output register, the apparatus comprising a subtractor for subtracting a signal corresponding to the charge accumulated during the transfer mode and transferred to the output register as lines corresponding to the at least one masked row, from the line signals corresponding to the rows of the image area.

35

12. Apparatus according to claim 11, wherein the CCD imager further comprises a store arranged between the image area and the output register.

5 13. Apparatus according to claim 11 or 12, wherein the CCD sensor comprises a plurality of masked rows.

10 14. Apparatus according to claim 13, wherein a line signal is generated corresponding to each masked row and the error signal is generated from an average of the masked row line signals.

15 15. Apparatus according to any preceding claim, comprising a gain controller for varying the gain of the multiplication register for selected images or portions of images.

20 16. Apparatus according to claim 15, wherein the gain is adjusted to be relatively high and relatively low on alternate lines of the image.

25 17. Apparatus according to claim 16, wherein the gain is adjusted to be relatively high and relatively low on alternate images.

18. A CCD imaging apparatus comprising apparatus according to any of claims 1 to 17.

30 19. A CCD camera comprising a CCD imager and apparatus according to any of claims 1 to 17.